

# Map 247A. COMPILATION BEDROCK GEOLOGY SERIES FOND-DU-LAC, NTS AREA 740

SASKATCHEWAN  
Scale 1:250 000

Kilometres 5 0 5 10 15 20  
Miles 5 0 5 10 15 20

FIRST EDITION, 1989

## GEOLOGICAL NOTES

The Fond-du-Lac area is underlain by Archean/Archean basement rocks of the Athabasca Group in the south and Archean to Archean crystalline basement rocks in the north. The Archean igneous belt is quite extensive over the Athabasca Group rocks, but relatively limited over the basement rocks. Immediately north of Lake Athabasca, there is up to 10 percent bedrock exposure locally but this decreases to the north and east.

The crystalline basement rocks have been subdivided into a number of lithostratigraphic domains (Gilroy, 1981; Macdonald, 1983) which comprise part of the larger Rye River province (Hoffman, 1983). They include the Ena Lake Complex to the northwest, the Dodge Domain to the northeast, the Neve Lake Block to the south, and the Tanito Domain to the south. The Tanito Domain underlies the central part of the Fond-du-Lac area and is considered to be Archean in age.

The common occurrence of hypersthene in the Fine Channel Assemblage indicates granulite facies metamorphism was attained, although amphibolite facies retrogression has replaced much of the hypersthene with hornblende and biotite, and garnet with biotite. The lack of hypersthene and the association of garnet, muscovite and sillimanite in psammopelitic rocks of the Grease River Assemblage suggests middle to upper amphibolite facies conditions prevailed. Chloritization of biotite is common along several of the faults and indicates local greenschist facies retrogression.

In the Neve Lake Block (Harpur, 1986) has described three recognizable major folding episodes (F<sub>1</sub>) and at least three high-grade metamorphic peak events (M<sub>1</sub>, M<sub>2</sub>) and one major retrograde event (M<sub>3</sub>). Early overthrust east-trending isoclinal folds (F<sub>1</sub>) with southward-dipping axial planes accompanied the first granulite facies metamorphic event (M<sub>1</sub>) and were followed by upright north-south-striking folds (F<sub>2</sub>). More open, north-south-striking upright folding (F<sub>3</sub>) followed the peak granulite facies metamorphic event (M<sub>2</sub>) and were in turn followed by low pressure granulite to upper amphibolite facies metamorphism (M<sub>3</sub>). Interference between the (F<sub>2</sub>) and (F<sub>3</sub>) events produced the characteristic dome-and-basin to mushroom structural style in the domain. The northeast margin of the Neve Lake Block is defined by the Oldman-Buaya Lakes Shear Zone which may represent a major suture zone. The deformational event producing the shear zone was accompanied by regional amphibolite facies retrogression (M<sub>3</sub>). Retrogression continued to the south of the shear zone. The deformational event producing the shear zone was accompanied by regional amphibolite facies retrogression (M<sub>3</sub>).

The Dodge Domain possesses an early regional greenschist deformation by regional nappe formation (F<sub>1</sub>) with possible overthrusting shallowly southward-dipping southeast-striking axial planes (Gilroy, 1979). These were deformed by later north-south-striking folds (F<sub>2</sub>) and a penetrative moderately west- to southward-plunging lineation (L<sub>1</sub>) with the west (Gilroy and Ramakers, 1981). Although regional metamorphism reached the granulite facies, much of the area has been retrogressed to the middle amphibolite facies.

The Tanito Domain is deformed by folds with at least two different axial plane orientations (Scott, 1980; Thomas, 1980; Harpur, 1986). A regional gneissic foliation outcrops right to local overturned folds (F<sub>1</sub>) with shallow southerly dipping axial planes striking east to southeast. A second fold event (F<sub>2</sub>) is characterized by upright north-south-striking northward-plunging lineation resulting from the intersection between F<sub>1</sub> and F<sub>2</sub> axial surfaces is common. Scott (1980) goes on to suggest a third north-trending fold (F<sub>3</sub>) of possible syn- or post-F<sub>2</sub> age. Progressive metamorphism to the upper amphibolite facies is most prevalent in the area, although the rare occurrence of hypersthene indicates some areas attained granulite facies metamorphism.

The Ena Lake Complex is a subvolcanic to shallow north-south-plunging mineral lineation commonly parallels north-trending axial planes of the Ena Lake Complex (Koster, 1981). Outcrop patterns and local reversal of lineation plunges suggests a second, more open folding event occurred along north-trending axial planes. The presence of ortho- and clinopyroxene in the rocks indicates granulite facies metamorphism was attained.

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In the Wilson Lake Block, rocks commonly display cataclastic textures probably due to several east to southeast-trending splays originating from the Oldman-Buaya Lakes Shear Zone. A shallow to moderate south- to southeast-plunging lineation is present in the area. The intensity towards the shear zone. Various late northward to north and east-trending thrust faults typically form a series of north-south-trending belts of medium- to coarse-grained coarsely-foliated rocks.

The Grease River Assemblage, in the northern part of the area, is a layered group of biotite gneisses (unit Tn) with compositions ranging from granite to quartz diorite. Textures range from near massive to weakly foliated and from medium- to fine-grained. The assemblage is represented by a variety of mineralogical facies including biotite, hornblende, quartz, and sillimanite. The assemblage is commonly associated with muscovite-bearing granite and quartz diorite.

The Ena Lake Complex (Macdonald, 1983a), which is analogous to Koster's (1980) "Northern Complex", is a subvolcanic to shallow north-south-plunging mineral lineation commonly parallels north-trending axial planes of the Ena Lake Complex (Koster, 1981). Outcrop patterns and local reversal of lineation plunges suggests a second, more open folding event occurred along north-trending axial planes. The presence of ortho- and clinopyroxene in the rocks indicates granulite facies metamorphism was attained.

The Dodge Domain (Gilroy and Ramakers, 1981) comprises finely layered to homogeneous felsic (unit Dm), mafic (unit Dm) and mixed (unit Dm) hornblende rocks of uncertain origin. To the east of the Fond-du-Lac map area, these rocks have been interpreted as a variety of facies including biotite, hornblende, quartz, and sillimanite. The assemblage is commonly associated with muscovite-bearing granite and quartz diorite.

The Tanito Domain (Macdonald, 1983a), underlying the north-central part of the map, is characterized by migmatitic biotite and hornblende quartzolite gneisses (unit Tn). The Tanito Domain is deformed by folds with at least two different axial plane orientations (Scott, 1980; Thomas, 1980; Harpur, 1986). A regional gneissic foliation outcrops right to local overturned folds (F<sub>1</sub>) with shallow southerly dipping axial planes striking east to southeast. A second fold event (F<sub>2</sub>) is characterized by upright north-south-striking northward-plunging lineation resulting from the intersection between F<sub>1</sub> and F<sub>2</sub> axial surfaces is common. Scott (1980) goes on to suggest a third north-trending fold (F<sub>3</sub>) of possible syn- or post-F<sub>2</sub> age. Progressive metamorphism to the upper amphibolite facies is most prevalent in the area, although the rare occurrence of hypersthene indicates some areas attained granulite facies metamorphism.

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### LEGEND

**PALEOHELIQUAN  
ATHABASCA GROUP**

**OF** **Orthoclase Formation:** sandstone and minor siltstone of marine origin

**OF** **Lower Lake Formation:** mainly pebbly sandstone of marine origin

**WP** **Wolverine Point Formation:** marine sandstone and siltstone

WP: mainly siltstone and clay-rich sandstone, phosphatic, lenticular

WP: mainly sandstone, minor siltstone

**MF** **Marine Facies Formation:** mainly fine-grained sandstone and conglomerate

MF: interbedded rich sandstone (fluviatile)

MF: interbedded coarse sandstone and siltstone (fluviatile)

**UNCONFORMITY**

**Cataclastic rocks:** green, pink and black finely laminated chert, mylonite and mylonitic gneisses, typically contain epidote-filled fractures, include angular and red brecciated gneisses

### ENA LAKE COMPLEX

AGE UNCERTAIN, POSSIBLY ARCHEAN

**Amphibolite:** dark green to black, fine to coarse grained, uniform to well layered, mainly granodioritic to gabbroic, accessory sphene, apatite, zircon and quartzolite, probable mafic gneiss origin

**Eq** **Basaltic gneiss:** white to grey, fine to coarse grained, uniform to well layered, mainly granodioritic to gabbroic, accessory sphene, apatite, zircon and quartzolite, probable mafic gneiss origin

**Eq** **Felsic to mafic granulites:** mixed group of rocks with granodioritic to gabbroic composition, light to dark greenish-grey, fine to medium grained, uniform to foliated or migmatitic, amphibole + quartz + pyroxene ± garnet, accessory magnetite, apatite and zircon

### TRAIN LAKE DOMAIN

PROBABLY MAINLY APHEBIAN

**Tn** **Granite and pegmatite:** pink to red, fine grained to porphyritic, massive to weakly foliated, locally contains 30 to 70 percent microcline phenocrysts, less than 15 percent biotite, zircon and quartzolite, probable mafic gneiss origin

**Tn** **Granite - quartz monzonite - granodiorite:** light grey to pink, medium grained, massive to columnar, magmatic granodioritic boundaries with surrounding quartzolite gneisses (unit Tn) and Tn: 5 to 15 percent biotite, 5 to 15 percent hornblende, accessory sphene, apatite, zircon and quartzolite, probable mafic gneiss origin

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### DODGE DOMAIN

POSSIBLY ARCHEAN

**Dm** **Biotite-amphibolite gneiss:** light grey to green, fine to coarse grained, poorly foliated, locally well foliated, 20 to 40 percent biotite and hornblende ± hypersthene ± garnet, accessory magnetite, apatite and zircon

**Dm** **Garnet quartzolite gneiss:** white to grey, fine to medium grained, well foliated, garnet porphyroblasts up to 5 cm in diameter locally retrogressed to biotite ± pyroxene ± quartzolite, accessory magnetite, apatite and zircon

### TANTATO DOMAIN

POSSIBLY ARCHEAN

**Tn** **Granite and pegmatite:** dark grey to black, fine grained, massive to weakly foliated, locally well foliated, 20 to 40 percent biotite and hornblende ± hypersthene ± garnet, accessory magnetite, apatite and zircon

**Tn** **Biotite quartzolite gneiss:** pink to grey, fine to coarse grained, schistose to well layered, mainly granodioritic to tonalitic composition, up to 20 percent hornblende and 10 percent biotite, accessory sphene, apatite, zircon, epidote, carbonate, chlorite, muscovite and magnetite, possible gneiss origin

**Tn** **Biotite hornblende quartzolite gneiss:** pink to grey, fine to coarse grained, schistose to well layered, mainly granodioritic to tonalitic composition, up to 20 percent hornblende and 10 percent biotite, accessory sphene, apatite, zircon, epidote, carbonate, chlorite, muscovite and magnetite, possible gneiss origin

**Tn** **Mafic gneiss:** medium to dark grey, fine to medium grained, poorly layered, mainly mafic, quartz, sphene, epidote and quartz monzonitic composition, possible volcano-sedimentary origin

**Tn** **Pelite rocks:** medium to dark grey, fine to medium grained, massive to weakly foliated, 20 to 40 percent biotite, 5 to 15 percent hornblende, accessory sphene, apatite, zircon and quartzolite, probable mafic gneiss origin

**Tn** **Amphibolite:** dark green to black, fine grained, massive to weakly foliated, locally well foliated, 20 to 40 percent biotite and hornblende ± hypersthene ± garnet, accessory magnetite, apatite and zircon

**Tn** **Mafic hypersthene gneiss:** dark grey to black, fine grained, highly foliated, north-south-trending, 20 to 70 percent hypersthene ± plagioclase ± biotite ± quartzolite, probable gneiss origin

**Tn** **Biotite schist:** brown, fine to medium grained, schistose, 25 to 40 percent biotite ± plagioclase ± quartz ± muscovite ± garnet ± magnetite, schistose to chlorite ± hornblende ± quartzolite ± sphene, probably derived from biotite gneiss (unit Tn)

**Tn** **Biotite gneiss:** mixed group of variably mylonitized rocks including foliated biotite gneiss, hornblende gneiss, foliated felsic biotite gneiss, biotite-feldspar augen gneiss, hornblende biotite gneiss, hornblende gneiss and garnetiferous hornblende-biotite gneiss, probable gneiss origin

**Tn** **Garnet-feldspar gneiss:** grey to white, fine to medium grained, well layered, 20 to 40 percent biotite, 5 to 15 percent hornblende, accessory sphene, apatite, zircon and quartzolite, probable mafic gneiss origin

**Tn** **Garnet-feldspar gneiss:** grey to white, fine to medium grained, well layered, 20 to 40 percent biotite, 5 to 15 percent hornblende, accessory sphene, apatite, zircon and quartzolite, probable mafic gneiss origin

### NEVE LAKE BLOCK

PROBABLY MAINLY ARCHEAN

**Ng** **Granite and pegmatite:** white, medium to coarse grained, massive, 10 to 20 percent muscovite, 5 to 15 percent biotite, contains numerous quartz veins and quartz-feldspar dykes and sills, late intrusive origin

**Ng** **Granodiorite:** light grey to pink, medium grained, schistose, biotite and hornblende, accessory sphene, apatite, magnetite, chlorite and zircon

**Ng** **Amphibolite:** brown to dark grey to black, medium to coarse grained, massive to porphyritic, greater than 50 percent mafic, hornblende ± diopside ± biotite ± plagioclase ± hypersthene ± actinolite ± chlorite ± quartzolite ± sphene, pyrite, magnetite, ilmenite and zircon, probable gneiss origin

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